

### ***Claims***

What is Claimed Is:

5 1. A selectively reconfigurable shrink-wrap machine  
for use with a loading device for individually wrapping  
products sequentially with shrink-wrap material wherein  
the loading device delivers products in sequence to the  
machine for wrapping with shrink-wrap material, the  
10 shrink-wrap machine comprising:

a sensor associated with the loading device for  
sensing product position on the loading device;

a film supply for presenting a roll of shrink-wrap  
material;

15 a wrapping station at which products are wrapped  
with film material from the film supply;

a first conveyor for carrying products wrapped in  
the film material between the wrapping station and a  
film sealing and cutting apparatus, the first conveyor  
20 being driven to deliver products sequentially in  
synchronized velocity with the loading device in  
response to signals generated by the sensor;

a second conveyor;

25 the film sealing and cutting apparatus having an  
upper head and a lower head at least one which heads is  
driven for movement into and out of engagement with the  
other head between adjacent film wrapped products  
received by the first conveyor for effecting a seal  
between adjacent products, the upper head and the lower  
30 head each maintaining a fixed angle of orientation  
relative to a direction of movement of products along

the first conveyor, the second conveyor being disposed adjacent the film sealing and cutting apparatus for receiving wrapped products sequentially from the sealing and cutting apparatus as they are delivered by the first conveyor and as they are sequentially sealed and cut;

a microprocessor-driven control system having a touch sensitive viewing and controlling means for prompting and receiving operator response for controlling operation of the shrink-wrap machine, the control system having microprocessor circuits selectively programmed for control of at least one of a plurality of different possible wrapping stations or modes of operation.

2. The shrink-wrap machine according to claim 1 wherein the first conveyor is driven at a lesser velocity than the loading device in response to signals generated by the sensor, the seal between adjacent film wrapped products being enhanced by a leading end portion of a leading adjacent film wrapped product engaging the second conveyor, which travelling at a slower velocity than the first conveyor, to provide reduced spacing between a trailing end of the leading film wrapped product and a leading end of a following adjacent film wrapped product for reducing the amount of film tension therebetween.

3. The shrink-wrap machine according to claim 1 wherein the film sealing and cutting apparatus is driven by a servo motor.

4. The shrink-wrap machine according to claim 1 wherein the first conveyor is driven by a stepper motor.

5 5. The shrink-wrap machine according to claim 1 wherein the upper and lower heads are maintained with a vertical axial orientation relative to a direction of movement of products along the first conveyor.

10 6. The shrink-wrap machine according to claim 1 wherein the upper and lower heads are maintained with a vertical axial orientation relative to a direction of movement of products along the first conveyor by an epicyclical engagement therewith.

15 7. The shrink-wrap machine according to claim 1 wherein the travel path of at least one of the upper head and lower head is predetermined.

20 8. The shrink-wrap machine according to claim 1 wherein the travel path of at least one of the upper head and lower head is of closed geometry.

25 9. The shrink-wrap machine according to claim 1 wherein the travel path of at least one of the upper head and lower head is circular.

30 10. The shrink-wrap machine according to claim 1 wherein the upper head and lower head travel mutually toward and away from each other about a predetermined path.

11. The shrink-wrap machine according to claim 1  
wherein the upper head and lower head travel mutually  
toward and away from each other about a predetermined  
path engaging once every movement cycle to effect a  
sealing and cutting operation between adjacent film  
wrapped products.

12. The shrink-wrap machine according to claim 1  
wherein the upper head and lower head travel mutually  
toward and away from each other about a closed  
geometric path.

13. The shrink-wrap machine according to claim 1  
wherein the upper head and lower head travel mutually  
toward and away from each other about a circular path.

14. The shrink-wrap machine according to claim 1  
wherein the control system additionally permits the  
operator to selectively input a plurality of sets of  
package dimensions and pertinent operating parameters  
and to save each set of package dimensions and  
pertinent parameters for immediate future retrieval by  
the operator.

15. The shrink-wrap machine according to claim 1  
wherein the operator may reconfigure the shrink-wrap  
machine to accept a product having different dimensions  
without having to make any other adjustments to the  
shrink-wrap machine.

16. The shrink-wrap machine according to claim 1 wherein the viewing and controlling means is selectively configurable such that an operator can be situated to either side of the shrink-wrap machine to operate and monitor the shrink-wrap machine, whereby operation of the machine is ambidextrous.

17. The shrink-wrap machine according to claim 1 wherein to sense product position on the loading device, the sensor actually senses a product propelling means on the loading device, whereby the sensor generates signals to the first conveyor for synchronous movement with the loading device so that irrespective the presence of products on the loading device, the film sealing and cutting apparatus will continue to effect seals between assumed positions of adjacent products as if the products were present.

18. The shrink-wrap machine according to claim 1 wherein the film supply includes a film delivery apparatus having a pair of vertical support members further having a spindle member interposed therebetween for carrying a roll of shrink-wrap film to present film to the wrapping station, the spindle member includes an outside shaft journaled about a central shaft nonrotatably connected at a proximal end to one of the vertical support members, an adjustment collar and an adjacent locking nut threadedly engaged with a distal end of the central shaft, the locking nut for preventing the adjustment collar from rotating with respect to the central shaft by rotating the locking

nut with respect to the adjustment collar until there is secure contact therebetween, the adjustment collar permitting an operator to adjust the position of a roll of shrink-wrap film along the longitudinal axis of the hollow shaft while the shrink-wrap machine is in operation.

19. The shrink-wrap machine according to claim 2 wherein one of the vertical support members includes at least one pair of first and second sensing devices mounted thereon connected to an operator warning device for warning the operator of a predetermined extent of depletion and of total depletion, respectively, of a roll of shrink-wrap film used with the shrink-wrap machine;

an indexing device including an elongated portion having a proximal end and a distal end extending through the vertical support member in rotational engagement therewith for correlating the extent of film roll depletion to the sensing devices;

a first sensing member extending from the proximal end of the elongated portion and a second sensing member extending from the distal end of the elongated portion, the first and second sensing members being in a predetermined angular relationship with each other with respect to the longitudinal axis of the elongated portion;

a retarding device including an elongated member extending from the vertical support member securing a flexible retarding member in non-marring frictional engagement with the periphery of a roll of shrink-wrap

film, the first sensing member resting atop the flexible retarding member for monitoring the amount of shrink-wrap material remaining on a roll, the second sensing member pivotally adjacent the first and second sensing devices; wherein as the roll of shrink-wrap film is expended, the first sensing member which maintains an offset tangential contact along the radius of the roll due to the thickness of the flexible retarding member, rotates about the longitudinal axis of the elongated portion, as does the second sensing member, wherein as the film roll of shrink-wrap film is expended to a predetermined level, the second sensing member achieving such proximity with the first sensing device as to activate the first sensing device and thereby alert the operator of a predetermined level of depletion of a film roll, and upon the roll being totally expended, the second sensing member achieving such proximity with the second sensing device as to activate the second sensing device and thereby alert the operator that the film roll has been totally expended.

20. A selectively reconfigurable shrink-wrap machine for use with a loading conveyor for individually wrapping products sequentially with shrink-wrap material wherein the loading conveyor delivers products in sequence to the machine for wrapping with shrink-wrap material and includes a plurality of lugs positioned at predetermined spacing intervals along the periphery of the loading conveyor such that products on the loading conveyor are positioned between adjacent

lugs and in contact with at least one of the lugs with respect to the direction of travel of the loading conveyor; the shrink-wrap machine comprising:

5 a sensor associated with the loading conveyor for sensing the position of the lugs as the lugs travel past the sensor;

a film supply disposed adjacent the loading conveyor including a film delivery apparatus for presenting a roll of shrink-wrap material;

10 a modular wrapping station for wrapping products by directing film material from the film supply and through the wrapping station to closely enwrap products peripherally along their longitudinal axes within a continuous tube of the film material so that the tube is formed therearound, wherein opposing ends of shrink-wrap material enwrapping the products form a region of overlapping shrink-wrap material along the products' longitudinal axes, the modular wrapping station being disposed adjacent the loading conveyor, the lugs propelling the products into the wrapping station;

15 a sealing device in association with the modular wrapping station for establishing a continuous seam along the region of overlapping shrink-wrap material of the tube by bonding the overlapping opposing ends of the shrink-wrap material to one another as the continuous tube of film material securely containing the products therein travels past the sealing device;

20 a vacuum conveyor associated with the modular wrapping station for carrying the tube containing the closely wrapped products therein away from the sealing device after the sealing device has established the



continuous seam along the region of overlapping shrink-wrap material by pulling the tube along its longitudinal axis, the vacuum conveyor being driven by a motorized means to deliver products sequentially in  
5 synchronized velocity with the loading conveyor in response to electrical signals generated by the sensor;  
an exit conveyor;

a film sealing and cutting apparatus for movement into and out of engagement between adjacent film  
10 wrapped products such that as the sealing and cutting apparatus moves in and out of engagement it maintains a fixed angle of orientation that does not change, the sealing and cutting apparatus being disposed between the vacuum conveyor and the exit conveyor and including  
15 an upper head having a cutter portion eccentrically positioned thereon, the cutter portion being maintained with a predetermined axial orientation relative to a direction of movement of products along the vacuum conveyor by a predetermined engagement therewith  
20 further including a lower head having a platen head portion, the path of the cutter portion being predetermined, the cutter portion and the platen head portion being synchronously maintained mutually toward and away from each other about a predetermined path  
25 wherein the platen head portion and the cutter head portion are engaged once every full movement cycle of the upper and the lower heads to effect a sealing and cutting operation between adjacent film wrapped products; the exit conveyor adjacently disposed closely  
30 proximate the film sealing and cutting apparatus and at a predetermined gap from the vacuum conveyor for

carrying products sequentially therefrom, the film sealing and cutting apparatus being driven by a motorized means to deliver products sequentially in synchronized velocity with the loading conveyor in response to electric signals generated by the sensor, the exit conveyor being driven by a motorized means at a predetermined velocity with respect to the loading conveyor in response to electrical signals generated by the sensor;

10 a computer programmed control system which includes a touch sensitive viewing and controlling means for prompting and receiving operator response to control operation of the shrink-wrap machine, the control system having microprocessor circuits which are  
15 selectively programmed for control of at least one of a plurality of different possible modular wrapping stations or modes of operation, the different wrapping stations being configured to apply a unique sealing arrangement along region of overlapping shrink-wrap material enwrapping the products, the control system  
20 prompting an operator to selectively input the dimensions of a package and other pertinent operating parameters by manually interacting with the touch sensitive viewing and controlling means, the control  
25 system additionally permitting the operator to selectively input a plurality of sets of package dimensions and pertinent operating parameters and to save each set of package dimensions and pertinent parameters for immediate future retrieval by the  
30 operator, wherein the operator may reconfigure the shrink-wrap machine to accept a product having

different dimensions without having to make any other adjustments to the shrink-wrap machine, the viewing and controlling means being selectively configurable such that an operator can be situated to either side of the shrink-wrap machine to operate and monitor the shrink-wrap machine, whereby operation of the machine is ambidextrous.

21. A method for controlling a shrink-wrap machine comprising:

- a) initializing variables;
- b) setting scaling for the sealing head and the vacuum conveyor axes;
- c) setting error checking bits;
- d) selectively locating a film clamping zone and calculating a top dead center position for the sealing head;
- e) controlling normal operations of all motor axes;
- f) calculating ratios for web matching and cam following;
- g) monitoring all machine input/output ports by continuously scanning same;
- h) monitoring continuously all machine fault bits;
- i) executing commands based on error bits;
- j) repeating steps a) - c) and steps e) - i) upon user re-initialization of package size or other modes as long as machine is not turned off.